Effect of the Patient-Centered Medical Home on Racial Disparities in Quality of Care

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BACKGROUND: Research demonstrates that the patient-centered medical home (PCMH) is associated with improved clinical outcomes and quality of care, and the populations that can most benefit from this model require long-term management, e.g., persons with chronic illness and behavioral health conditions. However, different populations may not benefit equally from the PCMH, and empirical evidence about the effects of this model on racial disparities is limited.

OBJECTIVE: Estimate the association between enrollment in National Committee for Quality Assurance (NCQA)-recognized PCMHs and racial disparities in quality of care for adults with major depressive disorder (MDD) and comorbid medical conditions.

DESIGN: Applying a quasi-experimental instrumental variable design to account for differential selection into the PCMH, we used generalized estimating equations to determine the probability of receiving eight disease-specific quality measures.

SUBJECTS: Medicaid enrollees in three states not dually enrolled in Medicare, ages 18–64 with MDD and > 1 other chronic condition. A subgroup analysis was conducted for enrollees with comorbid diabetes.

INTERVENTIONS: Enrollment in an NCQA-recognized PCMH.

MAIN MEASURES: Disease-specific quality indicators for MDD (e.g., antidepressant use, receipt of psychotherapy), and for diabetes, (e.g. A1c testing, LDL-C testing, retinal exams, and medical attention for nephropathy).

KEY RESULTS: PCMH enrollment was associated with an increase in the overall likelihood of receiving six of eight recommended services and a decrease in the likelihood of receiving any psychotherapy (4.94 percentage points, $p < 0.01$) and retinal exams (5.51 percentage points, $p < 0.05$). Although both groups improved, PCMH enrollment was associated with an exacerbation of the Black-white disparity in adequate antidepressant use by 4.20 percentage points ($p < 0.01$).

CONCLUSIONS: While PCMH enrollment may improve the overall quality of care, the effect is inconsistent across

racial groups and not always associated with reductions in racial disparities in quality.

KEY WORDS: patient-centered medical homes; racial disparities; quality of care; chronic conditions.

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BACKGROUND

Persons with comorbid physical and behavioral health conditions are a priority for the U.S. healthcare system. Mental illnesses are the most prevalent comorbidities among high-cost Medicaid enrollees, and this population utilizes more healthcare across a wider range of services than the general population, making coordination of their care more difficult and leading to adverse health outcomes, higher mortality, and greater spending.^{1–4} Because behavioral health conditions complicate the management of physical disorders,⁵ coordinating care for persons with co-occurring conditions like major depressive disorder (MDD) may contribute to suboptimal quality of care.^{3, 6}

The intersection between physical and behavioral chronic conditions may be especially complex for racial minorities, who are disproportionately at risk for chronic comorbidities.¹ Compared with non-Hispanic-whites with common psychiatric disorders, Black and Hispanic/Latino patients with similar conditions report higher rates of diabetes, obesity, and cardiovascular disease.¹ Receipt of high-quality care for chronic conditions differs across racial/ethnic groups among people with mental illness.⁷ Given that racial/ethnic minorities are more likely to seek mental health services from primary care than mental health specialists,⁸ understanding the potential for primary care models to address the intersection between race, MDD, and chronic disease is critical to reduce disparities.^{1, 9, 10}

In primary care, the patient-centered medical home (PCMH) has the potential to improve clinical outcomes in

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complex populations with chronic physical and behavioral health conditions by organizing care delivery around a primary care provider (PCP) who leads a team responsible for coordinating patients' overall healthcare needs.^{11–16} Several organizations certify PCMHs; the most widely recognized program was developed by the National Committee on Quality Assurance (NCQA) in 2008¹⁷ and has been endorsed by a broad coalition of stakeholders, including national health plans, patient groups, and every major national physician organization.^{18, 19} Adoption of the PCMH has expanded rapidly; in 2018, 29 states reported serving some portion of their Medicaid population through a PCMH.^{20, 21}

However, different populations may not benefit equally from this model. Evidence about the effects of the PCMH in vulnerable populations is limited, and studies of racial disparities in quality in PCMH initiatives report mixed results.^{13, 22–24} One study found the PCMH reduced or eliminated racial disparities in preventive care reminders, cholesterol testing, and cancer screenings;²⁵ others observed varying effects among racial/ethnic groups,^{19, 26–28} with some finding no effect.²⁹ Because the PCMH is being widely adopted in Medicaid, assessing its potential to reduce disparities has significant policy implications.^{20, 21} We investigated the effects of NCQA-recognized PCMH practices on racial disparities in quality among Medicaid enrollees with comorbid MDD and chronic physical conditions.

METHODS

Setting

We include 2008–2011 Medicaid claims from three states with relatively high rates of Medicaid enrollment and complete claims data that were available for re-use for this analysis: North Carolina, Georgia, and Texas. This study was exempted from review by the Office of Human Research Ethics at the University of North Carolina at Chapel Hill (Study no. 16-2551).

Sample

We linked several administrative data sources: claims from the 2008–2011 Medicaid Analytic eXtract (MAX), provider specialty from the National Plan and Provider Enumeration System (NPPES), and PCMH recognition status from NCQA. We measured county-level supply of mental health professionals using data from the Area Health Resource File (AHRF)³⁰ and county-level socioeconomic status (SES) using the U.S. Census Bureau's Small Area Income and Poverty Estimates.³¹ The study population includes Medicaid enrollees age 18–64 years with MDD and > 1 other chronic medical condition. Dual enrollees in Medicare and Medicaid were excluded due to potentially incomplete pharmacy and utilization data.

We conducted subgroup analyses for enrollees with diabetes because of its high prevalence in Medicaid populations and

potential to interfere with managing MDD; diabetes also serves as a key tracer condition for understanding chronic care delivery more generally.^{4, 32} Further, racial/ethnic minorities experience higher rates of both conditions, and comorbid depression and diabetes is predictive of suboptimal outcomes in these groups.³²

To avoid “rule-out” diagnoses and/or coding errors, we required > 1 inpatient diagnosis or > 2 outpatient or emergency department diagnoses of MDD or diabetes during a single year in the study period, and > 1 claim for the condition in each year. We excluded individuals with serious mental illnesses (e.g., schizophrenia, bipolar disorder) because they are likely to see a behavioral health specialist as their primary point of care.³³

Measures

Disease-specific quality indicators for MDD or diabetes derived from Medicaid claims (Appendix Table 7) were chosen from recommended core quality measures for the PCMH,³⁴ the Centers for Medicare and Medicaid Services 2016 core set of adult quality measures for Medicaid,³⁵ and the Healthcare Effectiveness Data and Information Set (HEDIS).³⁶ To track treatment modality, we measured the likelihood that enrollees received any psychotherapy or antidepressant prescription; either modality is considered guideline-concordant for MDD.^{37, 38}

Seven recommended services were measured annually. Given the episodic nature of MDD, we also assessed the HEDIS antidepressant management measure for acute-phase treatment, defined as the likelihood that enrollees received > 84 days of antidepressants during an acute (120-day) episode.^{37, 39} Initiation of an acute episode was defined as 1) two outpatient services for MDD on different dates or 2) initiation of an antidepressant prescription. We required a washout period of > 3 months of Medicaid enrollment without MDD claims before a new episode. The end of an acute phase was defined as either 90 days without receiving MDD services or antidepressants or 120 days after the episode started.³⁷

The exposure of interest was enrollment in an NCQA-certified PCMH. Enrollees were attributed to the PCP (defined using taxonomy codes for internal medicine, family medicine, pediatrics, general practice, ambulatory clinics or centers, nurse practitioners, or physician assistants) that delivered the plurality of their non-hospital evaluation and management visits.⁴⁰ A provider's PCMH status was determined using NCQA recognition data. Enrollees receiving the same number of services from multiple providers were attributed to the provider with the most recent service date.⁴⁰ We conducted sensitivity analyses defining PCMH enrollment as having any claim with an NCQA-recognized PCMH provider during a given year rather than using the modal provider's status.

Enrollee-level covariates included age, sex, number of additional chronic comorbidities (defined using the Healthcare Cost and Utilization Project Chronic Condition Indicator),⁴¹

number of Medicaid-enrolled months, and rurality. Provider-level covariates included Federally Qualified Health Center or Rural Health Center status, and sex. We measured the supply of mental health professionals using county availability of psychiatrists and county-level Mental Health Professional Shortage Area (HPSA) status (full or partial). Finally, county-level SES measures included percent of the population under poverty and median income.

New enrollment in a PCMH can take one of two forms: seeking care from a recognized PCMH by switching providers or staying with a provider who became a PCMH. In either case, enrollment in a PCMH is non-random. To address possible selection bias from patient- or provider-level factors, we constructed two instrumental variables based on county rates of PCMH adoption: (1) the overall ratio of county PCMH adoption, defined as the number of PCMH providers in a county divided by the number of PCPs as measured by NCQA PCMH recognition data and the AHRF and (2) a similar county-level rate of NCQA medical home practices to all PCPs, contingent on the provider NPI appearing in Medicaid MAX claims during the study period. Both instruments are hypothesized to be associated with participation in a PCMH, regardless of the mechanism. Regional variation is assumed to be otherwise independent of enrollee-level quality outcomes, meaning that the only reason a region with a higher penetration of PCMH practices would have higher quality levels is through individual and practice participation decisions.

Defining and Measuring Disparities

The Institute of Medicine (IOM) defines a racial disparity as “racial or ethnic differences in the quality of health care that are not due to access-related factors or clinical needs, preferences, and appropriateness of intervention.”⁴² This definition distinguishes between the simple unadjusted difference in means or rates between racial groups and disparities driven by discrimination or other systematic factors.^{42, 43} Further, it includes the effects of mediating factors (other than health status and preferences), such as geography or SES.⁴²

Implementing the IOM definition to measure disparities requires generating counterfactual predictions of outcomes that minority groups would experience if their health status were identical to their white counterparts, adjusting for health status but no other factors explaining differences in quality or utilization.⁴³ In a nonlinear model, estimating this counterfactual requires simulation.^{43–45} Notably, this estimation method differs from analyses estimating a coefficient in a multivariate regression model while adjusting for other covariates. This estimator, the “residual direct effect” of race/ethnicity, is not concordant with the IOM definition of a disparity in that it does not distinguish between variable which may be legitimate drivers of differences in utilization and mediating factors such as SES which may represent race-related disadvantages.⁴⁵

Therefore, to estimate disparities consistent with the IOM definition we followed a process developed by McGuire and

colleagues: using non-Hispanic-whites as a reference group, we first fit a model describing relationships between quality/utilization and health status, race, and other characteristics. We then transformed the distributions of health status variables (e.g., age, gender, number of comorbidities) from the minority groups to be the same as those of non-Hispanic-whites, while leaving other variables unchanged; this created a counterfactual minority subgroup with distributions identical to the white subgroup. We then generated predictions using coefficients from the initial models and the transformed/counterfactual health status variables for minority groups by PCMH status, and aggregated predictions by racial group. To estimate precision, we generated measures of statistical significance using bootstrapping.⁴³

Statistical Analysis

We used generalized estimating equations (GEE) with a binomial family and logit link function. We selected an independent correlation structure selected based on the quasi-likelihood under the independence model criterion (QIC).⁴⁶ To address differential selection into the PCMH, we used two-stage residual inclusion (2SRI), an instrumental variable technique. Average marginal effects for the overall estimates were obtained using predictive margins. In the disparity models, predicted probabilities were obtained using the methods described above. All analyses were conducted using Stata (version 14).

The instruments were uniformly strong, with F-statistics of the joint significance of the two instruments ranging from 1048.92 to 4029.4.⁴⁷ The correlation between the instruments was 0.44, suggesting that although the two measure similar constructs, they capture different information and are both appropriate for inclusion in these models. The results of IV models should be interpreted as local average treatment effects, specifically the effect of the PCMH on outcomes for those who enroll because of county infrastructure or level of interest in medical homes.⁴⁸

RESULTS

The sample (Table 1) consisted of 310,906 person-years contributed by 191,565 unique individuals; 1.6% of person-years were accounted for by PCMH enrollees. PCMH enrollees were more likely to be Black (39.2% versus 30.1%, $p < 0.001$) and less likely to live in rural areas ($p < 0.001$) than non-enrollees. In unadjusted comparisons (Table 2), PCMH enrollees were significantly ($p < 0.01$) more likely to receive all recommended services except for psychotherapy and retinal exams.

Major Depressive Disorder Outcomes

PCMH enrollment was associated with a 4.88 percentage point increase in the overall receipt of any MDD treatment,

Table 1 Summary Statistics (Person-Years)

	N (%) or mean(SD)		
	Total	Non-PCMH	PCMH
N	310,906	306,040 (98.40%)	4866 (1.60%)
Diabetes	82,501 (26.50%)	81,304 (26.60%)	1197 (24.60%)
Race/ethnicity			
White	156,039 (50.20%)	153,529 (50.20%)	2510 (51.60%)
Black	94,167 (30.30%)	92,259 (30.10%)	1908 (39.20%)
Hispanic/Latino	37,516 (12.10%)	37,329 (12.20%)	187 (3.80%)
Female enrollee	246,694 (79.30%)	242,765 (79.30%)	3929 (80.70%)
Age	40.82 (13.57)	40.83 (13.57)	40.15 (13.35)
Months of Medicaid enrollment	10.771 (2.40)	10.77 (2.40)	10.801 (2.32)
Chronic comorbidities	5.23 (4.31)	5.23 (4.31)	5.32 (4.26)
County % under poverty	18.80 (5.72)	18.81 (5.75)	18.16 (3.63)
County median income	43,726.33 (9316.43)	43,702.24 (9351.32)	45,240.96 (6595.7111)
Rurality			
Metro-adjacent	65,664 (21.10%)	65,280 (21.30%)	384 (7.90%)
Rural	17,363 (5.60%)	17,292 (5.70%)	71 (1.50%)
Mental Health Professional Shortage Area (HPSA)			
Whole county	120,531 (38.80%)	119,977 (39.20%)	554 (11.40%)
Partial county	113,380 (36.50%)	110,821 (36.20%)	2559 (52.60%)
County supply of psychiatrists	49.70 (89.47)	49.43 (89.45)	66.47 (88.62)
State			
GA	84,958 (27.30%)	84,661 (27.70%)	297 (6.10%)
NC	137,198 (44.10%)	132,995 (43.50%)	4203 (86.40%)
TX	88,750 (28.50%)	88,384 (28.90%)	366 (7.50%)
Year			
2008	63,713 (20.50%)	63,713 (20.80%)	0 (0.0%)
2009	83,764 (26.90%)	83,674 (27.30%)	90 (1.80%)
2010	94,296 (30.30%)	92,649 (30.30%)	1647 (33.80%)
2011	69,133 (22.20%)	66,004 (21.60%)	3129 (64.30%)

whether psychotherapy or antidepressants, among enrollees with MDD ($p < 0.01$) (Table 3). This improvement was driven primarily by antidepressant use; PCMH enrollment was associated with a 5.94 percentage point higher rate of receipt of any antidepressants ($p < 0.01$), but also with a 4.94 percentage point overall lower rates of psychotherapy ($p < 0.01$). In the acute episodic MDD analyses, PCMH enrollment was associated with a 2.85 percentage point higher probability of receiving minimally adequate antidepressants ($p < 0.05$).

In the disparities models (Table 4), Black and Hispanic/Latino enrollees had higher predicted probabilities of receiving annual psychotherapy than white enrollees in both

the non-PCMH and PCMH groups (50.9% and 41.1% respectively, compared with 39.6% for whites); this pattern persisted among PCMH enrollees. However, this effect was heterogeneous across racial groups: PCMH enrollees had a lower predicted probability of receiving any psychotherapy for white and Black enrollees and a small increase for Hispanic/Latino enrollees. PCMH enrollment was associated with significant reductions in Black-white and Hispanic-white disparities in calendar-year antidepressant use (0.90 percentage points, $p < 0.05$ and 9.72 percentage points, $p < 0.01$, respectively). PCMH enrollment was also associated with a 6.81 percentage point reduction in

Table 2 Unadjusted Rates of Quality Metrics

	Non-PCMH N(%)	PCMH N(%)	p value (t test)
MDD			
Calendar-year			
Any psychotherapy	109,510 (40.6%)	1721 (39.3%)	0.066
Any antidepressants	159,948 (59.4%)	3174 (72.4%)	<0.001
Psychotherapy or antidepressants	203,058 (75.4%)	3728 (85.1%)	<0.001
N	269,460	4383	
Acute episode			
Min. antidepressants	40,297 (24.0%)	1035 (33.6%)	<0.001
N	167,910	3076	
Diabetes			
A1c testing	52,963 (65.0%)	918 (76.7%)	<0.001
Retinal exam	26,780 (32.9%)	346 (28.9%)	0.004
Lipid panel	40,450 (49.7%)	751 (62.8%)	<0.001
Attn for nephropathy	24,151 (29.6%)	489 (40.9%)	<0.001
N	81,483	1197	

Table 3 Average Marginal Effect of PCMH Enrollment on MDD Outcomes

	Calendar-year			Acute episode
	Any psychotherapy	Any antidepressants	Psychotherapy or antidepressants	Adequate antidepressants
PCMH enrollment	− 0.050** (0.011)	0.059** (0.011)	0.048** (0.0099)	0.029* (0.012)
Race				
Black	0.033** (0.0030)	− 0.14** (0.0029)	− 0.074** (0.0026)	− 0.15** (0.0025)
Hispanic/Latino	0.037** (0.0046)	− 0.055** (0.0044)	− 0.022** (0.0035)	− 0.080** (0.0048)
Chronic Conditions	− 0.0049** (0.00029)	0.0094** (0.00028)	0.00099** (0.00024)	0.0078** (0.00030)
Rurality				
Non-metro (adjacent to urban area)	− 0.00014 (0.0031)	− 0.010** (0.0030)	− 0.0080** (0.0027)	− 0.0095** (0.032)
Non-metro (non-urban adjacent)	− 0.040** (0.0050)	− 0.019** (0.0049)	− 0.036** (0.0045)	− 0.00094 (0.0052)
Enrollee age	− 0.0037** (8.58e-05)	− 0.0016** (8.53e-05)	− 0.0034** (7.65e-05)	0.002-** (8.84e-05)
Female enrollee	0.0093** (0.0026)	0.059** (0.0025)	0.040** (0.0023)	0.033** (0.0027)
Months of Medicaid enrollment	0.017** (0.00046)	0.011** (0.00042)	0.015** (0.00035)	0.0093** (0.00052)
FQHC	− 0.011** (0.0038)	0.053** (0.0036)	0.033** (0.0031)	0.0083** (0.0041)
RHC	− 0.028** (0.0048)	0.036** (0.0045)	0.022** (0.0038)	0.030** (0.0051)
Female provider	0.0053* (0.0026)	0.044** (0.0025)	0.034** (0.0021)	0.024** (0.0027)
County percent under poverty	0.0016** (0.00036)	− 0.0039** (0.00035)	− 0.0012** (0.00030)	− 0.0033** (0.00040)
County median income	1.62e-06** (2.33e-07)	− 1.79e-06** (2.24e-07)	− 2.96e-07 (1.96e-07)	− 9.14e-07** (2.50e-07)
County no. of psychiatrists	0.00018** (1.51e-05)	8.87e-05** (1.41e-05)	0.00013** (1.16e-05)	− 1.65e-05 (1.79e-05)
Mental health HPSA				
Whole county	0.014** (0.0031)	− 0.0039 (0.0030)	− 0.00084 (0.0027)	0.00048 (0.0032)
Partial county	0.023** (0.0028)	− 0.019** (0.0028)	− 0.0018 (0.0025)	− 0.0082** (0.0029)
State				
North Carolina	− 0.026** (0.0030)	0.078** (0.0028)	0.042** (0.0023)	0.036** (0.0032)
Texas	− 0.16** (0.0033)	− 0.16** (0.0035)	− 0.16** (0.0032)	− 0.077** (0.0035)
Year				
2010	0.0015 (0.0025)	− 0.025** (0.0024)	− 0.012** (0.0021)	− 0.011** (0.0026)
2011	− 0.0015 (0.0028)	− 0.0020 (0.0028)	0.0021 (0.0025)	0.036** (0.0031)
Pearson residual	− 0.049** (0.0098)	0.059** (0.010)	0.049** (0.0087)	0.0019 (0.0023)

Bootstrapped standard errors in parentheses

** $p < 0.01$, * $p < 0.05$

Hispanic-white disparities ($p < 0.01$) in receipt of either calendar-year measure. Finally, in episodic MDD analyses, PCMH enrollment was associated with a 4.20 percentage point increase in Black-white disparities ($p < 0.01$), but not with Hispanic-white disparities.

Diabetes Outcomes

Among 82,501 enrollees with diabetes (Table 5), PCMH enrollment was generally associated with significant ($p < 0.01$) increases in overall receipt of the overall probability of receiving a lipid panel (11.70 percentage points), A1c test (14.0 percentage points), and attention for nephropathy (7.53 percentage points). PCMH enrollment was associated with a 5.51

percentage point decrease in the likelihood of receiving a retinal exam ($p < 0.05$).

In disparity models (Table 6), Black enrollees not enrolled in a PCMH were 2.27 percentage points less likely to receive A1c testing ($p < 0.01$); there was no statistically significant disparity among PCMH enrollees. Statistically significant Black-white disparities also existed for both receipt of lipid testing and retinal exams. PCMH enrollment was associated with a non-significant reduction in Black-white disparities in lipid testing (from 7.36 to 3.71 percentage points) and retinal exams (from 6.45 to 5.70 percentage points). There were no statistically significant Black-white disparities in attention for nephropathy. Hispanic/Latino enrollees had higher rates of A1c testing and this advantage persisted among PCMH

Table 4 Comparison of Predicted Probabilities and Disparities Changes for MDD Outcomes

Any psychotherapy (annual)	White	Black	Disparity	Hispanic/Latino	Disparity
Non-PCMH	0.40** (0.0017)	0.51** (0.0025)	− 0.11** (0.0030)	0.41** (0.0035)	− 0.015** (0.0040)
PCMH	0.37** (0.007)	0.47** (0.0083)	− 0.096** (0.0042)	0.45** (0.011)	− 0.077** (0.0084)
Δ Disparity			0.017** (0.0032)		− 0.062** (0.0074)
Any antidepressants (annual)					
Non-PCMH	0.67** (0.0016)	0.53** (0.0026)	0.14** (0.0031)	0.44** (0.0039)	0.22** (0.0042)
PCMH	0.78** (0.0064)	0.65** (0.0082)	0.13** (0.0046)	0.66** (0.012)	0.13** (0.010)
Δ Disparity			− 0.0090* (0.0038)		− 0.097** (0.0094)
Psychotherapy or antidepressants (annual)					
Non-PCMH	0.79** (0.0014)	0.77** (0.0021)	0.018** (0.0025)	0.69** (0.0033)	0.099** (0.0036)
PCMH	0.87** (0.0050)	0.85** (0.0058)	0.022** (0.0033)	0.84** (0.0087)	0.031** (0.0072)
Δ Disparity			0.0040 (0.0030)		− 0.068** (0.0071)
Adequate antidepressants (episodic)					
Non-PCMH	0.27** (0.0017)	0.12** (0.0015)	0.15** (0.0022)	0.11** (0.0021)	0.20** (0.0027)
PCMH	0.38** (0.0094)	0.18** (0.0061)	0.20** (0.0054)	0.20** (0.011)	0.18** (0.0092)
Δ Disparity			0.042** (0.0050)		0.0076 (0.0085)

Bootstrapped Standard Errors in Parentheses

** $p < 0.01$, * $p < 0.05$

enrollees. There were no statistically significant Hispanic-white disparities for either treatment group in receipt of lipid panels or attention for nephropathy. A statistically significant Hispanic-white disparity existed in the PCMH group for retinal exams, but not for the non-PCMH group, suggesting that disparities were exacerbated among PCMH enrollees.

Sensitivity Analyses

Sensitivity analyses defining PCMH attribution as any claim with an NCQA-recognized provider produced results similar to the primary analyses in direction and significance, though the effect sizes were generally smaller in magnitude. One exception was the annual receipt of psychotherapy, where the effect of PCMH enrollment was almost double the primary analyses.

DISCUSSION

PCMH enrollment was associated with an increased likelihood of receiving six of eight recommended services; this is consistent with literature suggesting that the PCMH can improve the quality of care in Medicaid populations.^{15, 49} The two exceptions to this finding, psychotherapy and retinal exams, may result from these services not typically being provided in primary care settings. However, PCMH enrollment was associated with an increase in the receipt of any MDD treatment.

Some providers and policymakers believe that the PCMH should improve outcomes for all racial groups, with minority

groups benefitting more because they have the most room for improvement.²³ Overall, our findings do not support this belief; we only see this pattern in Black-white disparities in any antidepressant use and A1c testing and Hispanic-white disparities in any antidepressant use and use of either psychotherapy or antidepressants. In other cases (e.g., Black-white disparities in adequate episodic antidepressant use), PCMH enrollment improves outcomes for both the white and minority groups, but the disparity between the two is slightly exacerbated.

Notably, we found that minority enrollees (especially Hispanic/Latinos) were more likely to receive several recommended services than their white counterparts. These advantages generally persisted between the non-PCMH and PCMH groups. One possible explanation is that this sample is limited to individuals enrolled in Medicaid; previous studies have found that Hispanic-white disparities are largely driven by disparities in insurance coverage.^{50, 51} Another possibility is that we do not control for English fluency or language concordance between enrollee and provider. Previous studies have found that among insured enrollees, English-speaking Hispanic/Latino enrollees show a healthcare use pattern similar to non-Hispanic-white enrollees, while Spanish-speaking Hispanic/Latino enrollees had a significantly lower likelihood of having a physician visit or visit with a mental health provider, or receiving preventive services.⁵²

Many disparity-related concerns raised by our findings are reflected in the NCQA's updated 2017 PCMH recognition standards. These new standards have several criteria relating to equity of care, including "targeting population health

Table 5 Average Marginal Effect of PCMH Enrollment on Diabetes Outcomes

	Lipids	A1c	Retinal Exam	Attn for Nephropathy
PCMH Enrollment	0.12** (0.022)	0.14** (0.020)	−0.055* (0.025)	0.075** (0.026)
Race				
Black	−0.020** (0.0048)	0.0060 (0.0053)	0.022** (0.0045)	0.034** (0.0051)
Hispanic/Latino	0.034** (0.0073)	0.048** (0.0083)	0.045** (0.0073)	0.069** (0.0074)
Chronic Conditions	0.0068** (−0.00038)	0.010** (−0.00041)	0.015** (−0.00037)	0.013** (−0.00036)
Rurality				
Non-metro (adjacent to urban area)	−0.0091* (−0.0051)	−0.0077 (−0.0053)	−0.0015 (−0.0052)	−0.022** (−0.0051)
Non-metro (non-adjacent to urban area)	−0.055** (−0.0084)	−0.046** (−0.0085)	−0.034** (−0.0081)	−0.077** (−0.0078)
Enrollee age	−0.0018** (−0.00019)	−0.0034** (−0.00021)	2.433−05 (−0.00021)	−0.0023** (−0.00020)
Female Enrollee	0.0045 (−0.0042)	−0.00031 (−0.0044)	0.017** (−0.0043)	−0.0073* (−0.0042)
Months of Medicaid eligibility	0.024** (−0.00088)	0.019** (−0.00088)	0.014** (−0.0010)	0.010** (−0.0010)
FQHC	0.027** (−0.0061)	0.038** (−0.0062)	0.041** (−0.0064)	0.052** (−0.0064)
RHC	0.067** (−0.0078)	0.080** (−0.0079)	0.14** (−0.0086)	0.0063 (−0.008)
Female provider	0.063** (−0.0044)	0.087** (−0.0045)	0.034** (−0.0047)	0.067** (−0.0047)
County percent under poverty	0.0014* (−0.00059)	−0.0027** (−0.00061)	0.0029** (−0.00058)	−0.00017 (−0.00058)
County median income	8.46e-07* (−4.06e-07)	−1.36e-06** (−4.19e-07)	−1.10e-06** (−4.16e-07)	−5.05e-07 (−4.03e-07)
County no. of psychiatrists	−8.27e-05** (−2.46e-05)	−1.24e-05 (−2.68e-05)	−5.76e-05* (−2.46e-05)	6.30e-05** (−2.36e-05)
Mental health HPSA				
Whole county	0.028** (−0.0053)	0.0038 (−0.0055)	−0.026** (−0.0055)	−0.0040 (−0.0054)
Partial county	0.0045 (−0.0047)	0.0089* (−0.0051)	−0.020** (−0.0051)	0.0075 (−0.00493)
State (referent state = Georgia)				
North Carolina	0.40** (−0.0047)	0.14** (−0.0052)	0.080** (−0.0048)	0.055** (−0.0047)
Texas	0.51** (−0.0057)	0.20** (−0.0061)	0.12** (−0.0060)	0.10** (−0.0060)
Year (referent year = 2009)				
2010	−0.017** (−0.0042)	−0.0040 (−0.0043)	0.011** (−0.0044)	−0.0038 (−0.0042)
2011	−0.070** (−0.0048)	−0.053** (−0.0050)	−0.11** (−0.0048)	−0.025** (−0.0048)
Pearson residuals	−0.0048* (−0.0027)	−0.0066* (−0.0035)	0.015** (−0.0048)	0.0047* (−0.00246)

Bootstrapped standard errors in parentheses

** $p < 0.01$, * $p < 0.05$

management on disparities in care,” and “using information on the population served by the practice to assess equity of access.”⁵³ Our findings provide a baseline for future research to assess whether newer versions of the NCQA PCMH standards are more effective at reducing racial disparities in quality.

Limitations

This study has several limitations. First, enrollee-level SES data are not available in Medicaid claims data, leading us to use county-level measures. Second, PCMH recognition may not reflect services that practices provide. Non-PCMH primary care practices may engage in many of the same activities as NCQA-recognized PCMHs without seeking recognition due to financial or other concerns. Moreover, measures of enrollee

experience of care are not available in administrative data. Given that enrollee preference is a crucial aspect of the IOM definition of disparities, future research should take enrollee preference into account, perhaps using survey data. Third, the three states in our study have high rates of Medicaid enrollment and located in the southern U.S. However, research has suggested that geographic region or state alone does not explain disparities in health outcomes.⁵⁴ Fourth, the sample size for Latinos in the treated group is limited; however, we do see a statistically significant result in that population which indicates it is adequately powered for at least some analyses. Finally, because MAX data availability lags several years, our study (2008–2011) corresponds with Version 1 of the NCQA PCMH requirements. During the study period, North Carolina had a statewide, public Medicaid PCMH program

Table 6 Comparison of Predicted Probabilities and Disparities Changes for Diabetes Outcomes

	White	Black	Disparity	Hispanic/Latino	Disparity
Lipid panel					
Non-PCMH	0.47** (0.0035)	0.40** (0.0053)	0.074** (0.0062)	0.69** (0.0068)	− 0.21 (0.0075)
PCMH	0.63** (0.016)	0.59** (0.017)	0.037** (0.013)	0.65** (0.026)	− 0.022 (0.024)
Δ Disparity			− 0.037 (0.013)		0.19** (0.023)
A1c testing					
Non-PCMH	0.62** (0.0037)	0.60** (0.0056)	0.023** (0.0065)	0.74** (0.0064)	− 0.12** (0.0075)
PCMH	0.75** (0.015)	0.76** (0.014)	− 0.0088 (0.0092)	0.80** (0.016)	− 0.045** (0.013)
Δ Disparity			− 0.031 (0.008)		− 0.071** (0.012)
Retinal exam					
Non-PCMH	0.30** (0.0029)	0.24** (0.0037)	0.065** (0.0047)	0.33** (0.0063)	− 0.029 (0.0066)
PCMH	0.28** (0.0133)	0.22** (0.011)	0.057** (0.0084)	0.24** (0.016)	0.042** (0.014)
Δ Disparity			− 0.0075 (0.0072)		0.071** (0.013)
Attention for nephropathy					
Non-PCMH	0.26** (0.0030)	0.25** (0.0044)	0.0065 (0.0053)	0.34** (0.0066)	− 0.081 (0.0071)
PCMH	0.380** (0.015)	0.38** (0.015)	− 0.0014 (0.0097)	0.43** (0.020)	− 0.048 (0.015)
Δ Disparity			− 0.0079 (0.0078)		0.033** (0.013)

Bootstrapped standard errors in parentheses

** $p < 0.01$, * $p < 0.05$

that predated NCQA's PCMH recognition and used different standards; Georgia and Texas have since implemented public programs incentivizing PCMHs for their Medicaid populations.^{55–58}

CONCLUSIONS

These findings show that while the PCMH model may be associated with improvements overall quality of care, the effect is not necessarily consistent across racial groups. PCMH enrollment is sometimes, but not always associated with a reduction in racial disparities in quality of care, suggesting that the PCMH has potential to reduce disparities but implementing a PCMH model alone may not be sufficient to address the factors driving disparities. Providers and policymakers should explicitly consider the unique needs of minority populations in designing, implementing, and evaluating PCMH programs.

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APPENDIX

Table 7 Disease-Specific Dependent Variables

Variable	Definition	Calendar-year	Acute episode
Major depressive disorder			
Antidepressant use	Percent of newly diagnosed/treated enrollees with MDD who received any antidepressant prescriptions	X	
	Percent of newly diagnosed/treated enrollees with MDD who received at least 84 days of antidepressants during a 120-day acute episode		X
Psychotherapy	Percent of newly diagnosed/treated enrollees with MDD receiving any group/individual psychotherapy	X	
Diabetes			
A1C testing	Percent of diabetic enrollees receiving A1C testing	X	
LDL-C testing	Percent of diabetic enrollees receiving an LDL-C test	X	
Retinal exam	Percent of diabetic enrollees receiving a retinal exam	X	
Nephropathy screening	Percent of diabetic enrollees screened for nephropathy	X	